CERES/GERB/ScaRaB comparisons

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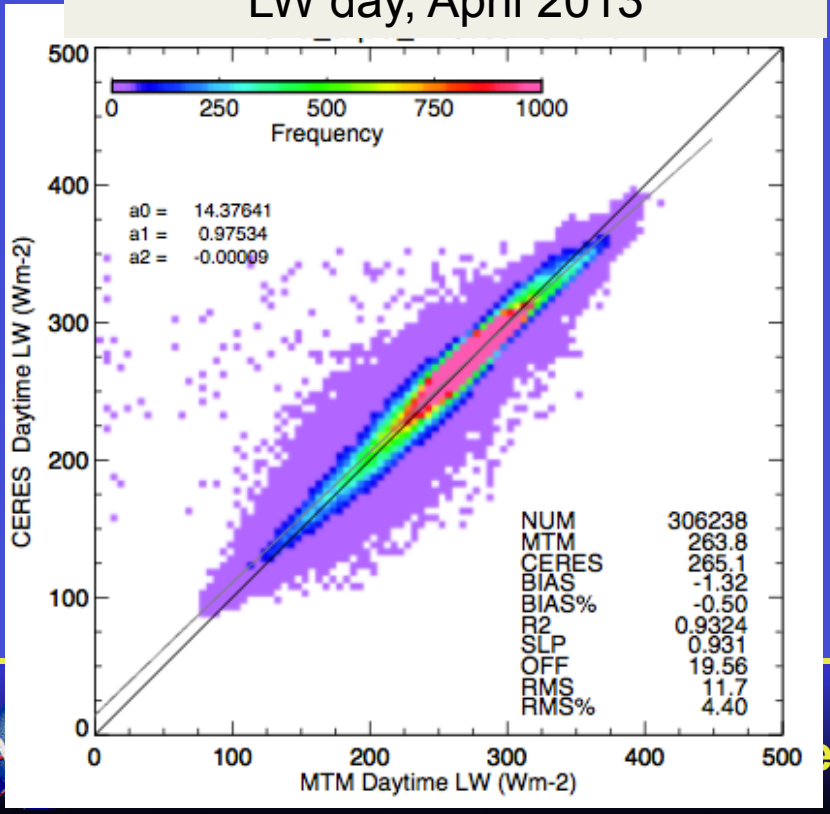
Megha-Tropique ScaRaB and CERES comparison

- MT1_L2B-FLUX-SCASL1A2-1.05 level 3 product
  - 1° by 1° latitude by longitude instantaneous gridded ScaRaB fluxes
  - ScaRaB Artificial Neural Network (SANN1) algorithm using both NB and BB ScaRaB channels
- CERES Edition 4 prototype TSI product
  - The Terra and Aqua fluxes are radiometrically scaled beginning in Ed3
- Regress CERES and ScaRaB instantaneous gridded fluxes to radiometrically scale ScaRaB with CERES
  - Scaling both the instrument calibration and the overall ADM difference
- Compare with April 2013 CERES Ed4 with 4 channel GEO cloud retrievals.
  - In the future compare with 2-3 Megha-Tropiques orbit repeat cycles (102-152 days or 3-5 months)

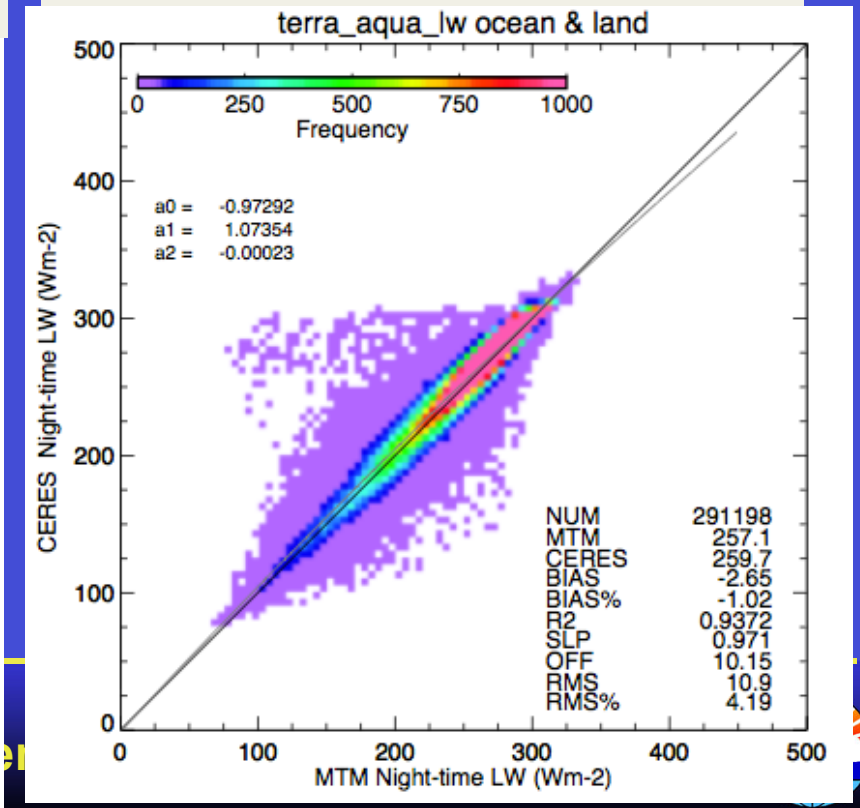
ScaRaB and CERES LW flux comparison

- 30 minute time matched collocated regional fluxes are regressed, (no angle matching)
- ScaRaB minus CERES bias = -0.5 to -1%, RMS error = 4%, day and night consistency

LW day, April 2013



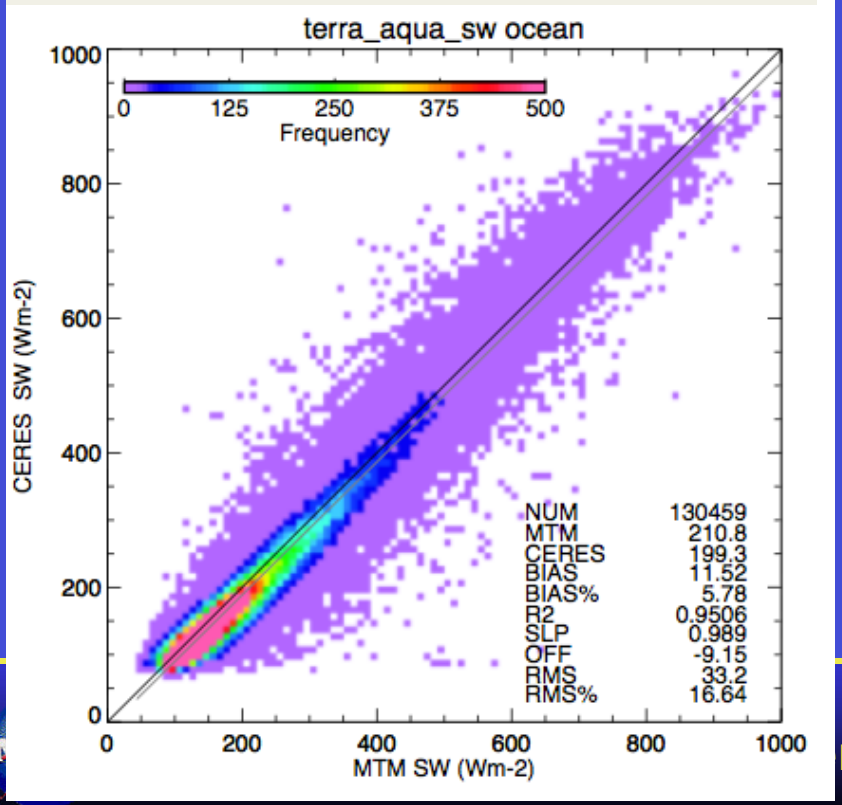
LW night, April 2013



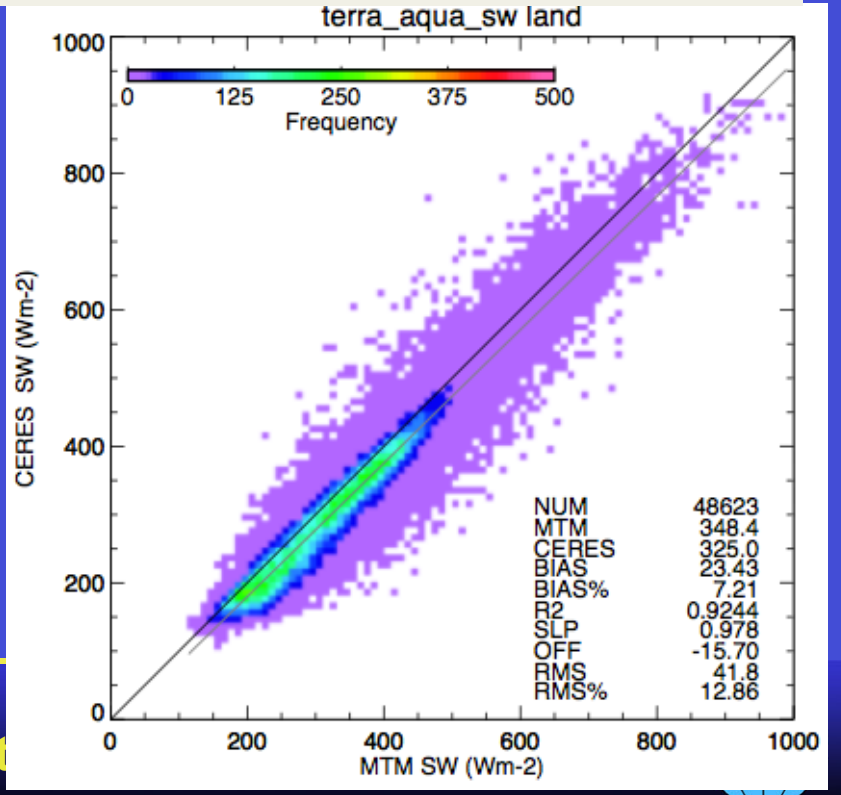
ScaRaB and CERES SW flux comparison

- 30 minute time matched collocated regional fluxes are regressed, (no angle matching)
- ScaRaB minus CERES SW bias = 6 to 7%, RMS error = 12-16%

SW ocean, April 2013



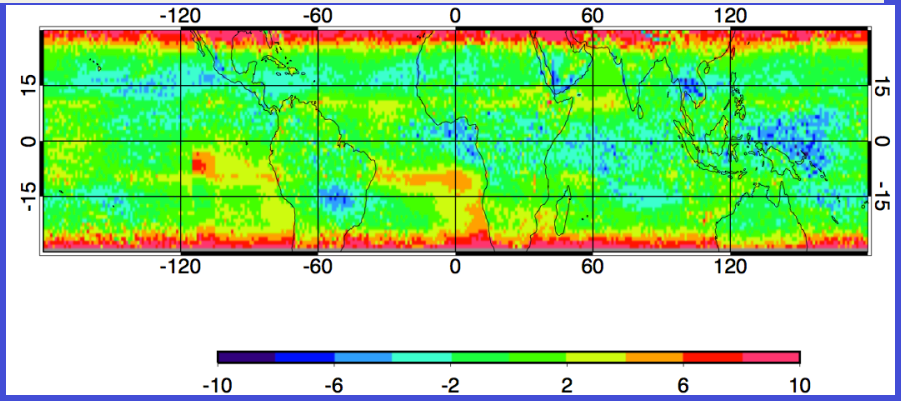
SW land, April 2013



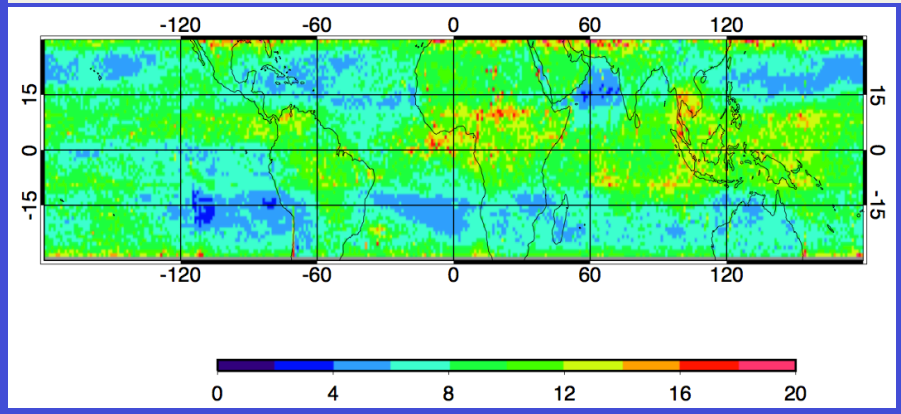
ScaRaB and CERES/GEO broadband fluxes

- Preliminary results show agreement on order of GERB
- 2/3 of coincident matches occur for VZA>45°
- Many 40-km overlapping ScaRaB footprints may sample outside of the 1° by 1 ° lat/lon region

GEO – ScaRaB LW bias (Wm^{-2}), April 2013



GEO – ScaRaB LW RMS(Wm^{-2}), April 2013



GEO LW normalized (%)	Bias	monthly	daily	3hour	1hour	M3hour	M1hour
GERB	0.14	0.59	1.48	2.43	2.77	0.92	1.07
ScaRaB (±25° latitude)	-0.32	1.05			3.44		

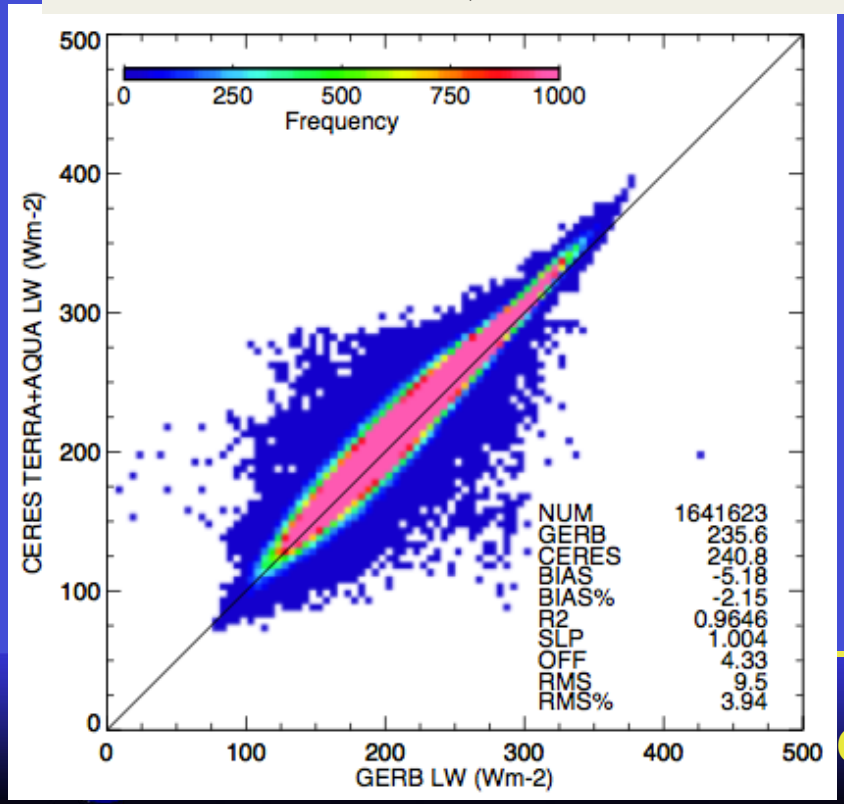
GERB and CERES comparison

- GERB Edition 1 BARG level 3 product
  - 1° by 1° latitude by longitude instantaneous gridded GERB fluxes
- CERES Edition 4 prototype TSI product
  - The Terra and Aqua fluxes are radiometrically scaled beginning in Ed3
- Regress CERES and GERB instantaneous gridded fluxes to radiometrically scale GERB with CERES
  - Compare with Jan 2005 (GERB 2, Met-8) and Jan 2010 (GERB-1, Met-9)
  - Scaling both the instrument calibration and the overall ADM difference
- This is a very limited comparison
  - Richard Bantges wrote the book on CERES and GERB differences
  - GERB team has extensively looked at GERB/CERES differences

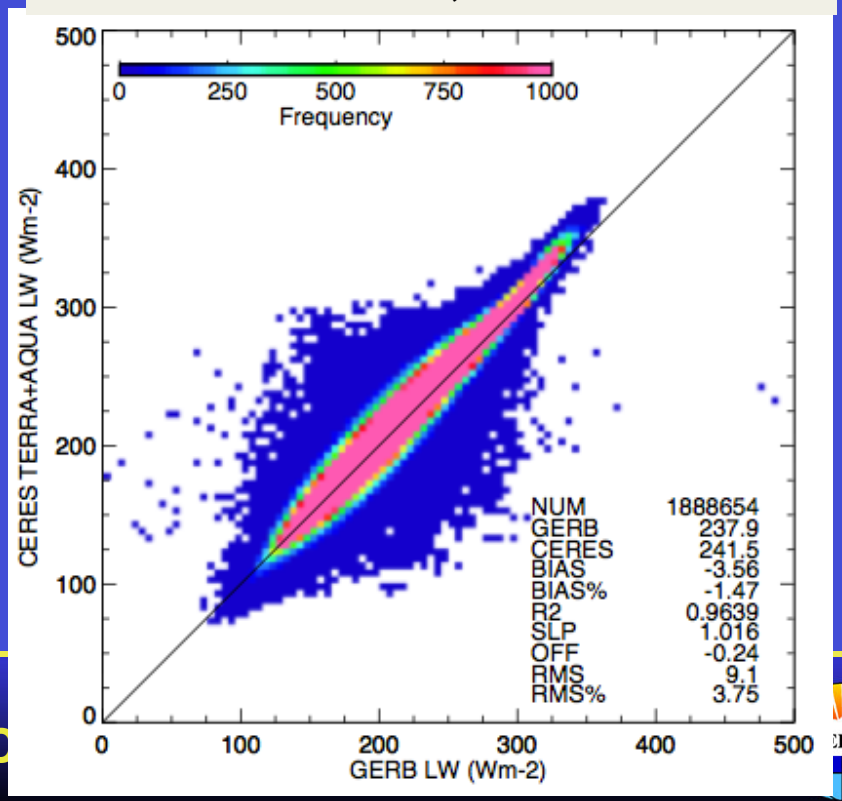
GERB and CERES LW flux comparison

- 15 minute time matched collocated regional fluxes are regressed, (no angle matching)
- GERB minus CERES bias = -1.5 to -2%, RMS error = 4%, consistent between the two GERBs

GERB-2 LW, Jan 2005



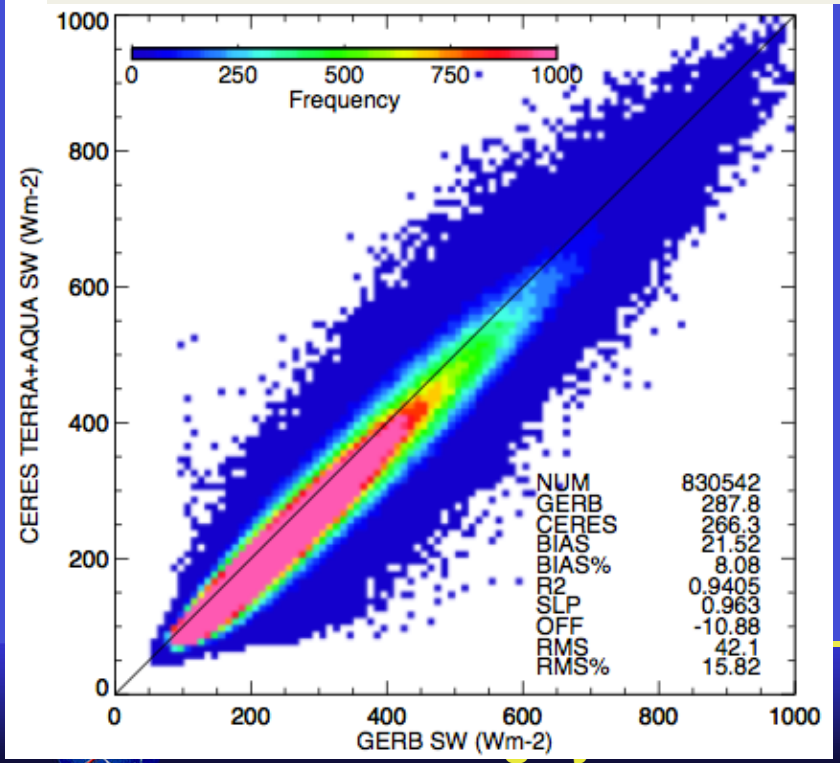
GERB-1 LW, Jan 2010



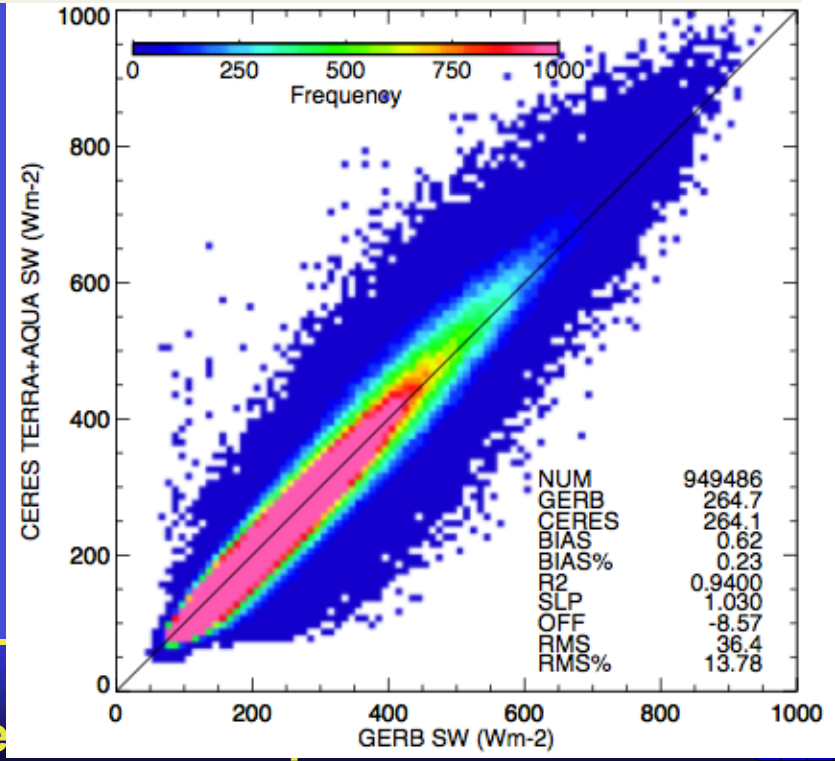
GERB and CERES SW flux comparison

- 15 minute time matched collocated regional fluxes are regressed, (no angle matching)
- GERB minus CERES bias = +8% (GERB-2) and 0% (GERB-1), RMS error = 15%, The two GERBs are not consistent

GERB-2, SW, Jan 2005



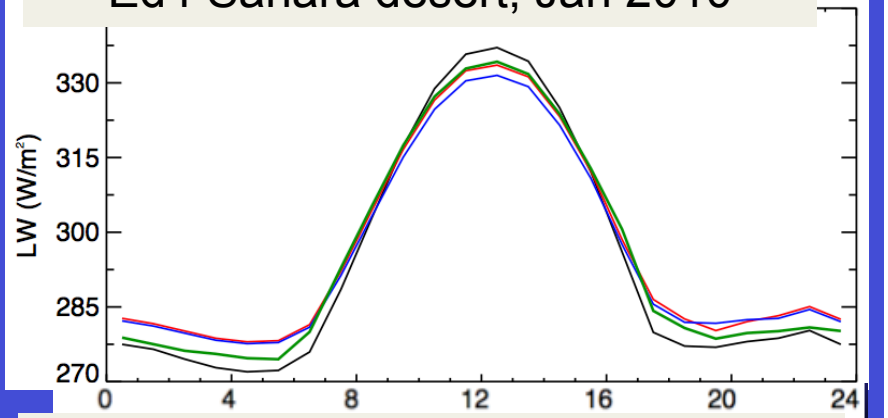
GERB-1, SW, Jan 2010



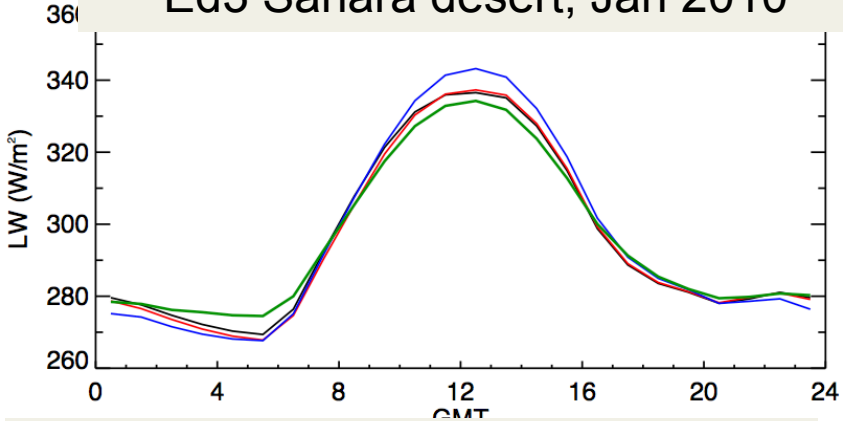
GERB and CERES/GEO comparison

- CERES Ed4 LW narrowband to broadband
  - Direct imager 6.7μm and 11 μm radiance to broadband flux conversion based on coefficients from SSF product using Aqua-MODIS imager and CERES broadband fluxes
  - First convert GEO imager 6.7 μm and 11μm radiances to MODIS equivalent radiances using coincident ray-matched fluxes
  - Normalize the GEO derived LW fluxes with CERES by regressing over a 5x5 regional domain all the 30 minute matched coincident fluxes
- Compare the GEO derived LW fluxes to the GERB fluxes
  - The GOES-13, Met-9, and Met-7 imager derived fluxes are evaluated
  - Compare monthly hourly averaged diurnal fluxes
  - Compare regionally before and after normalization

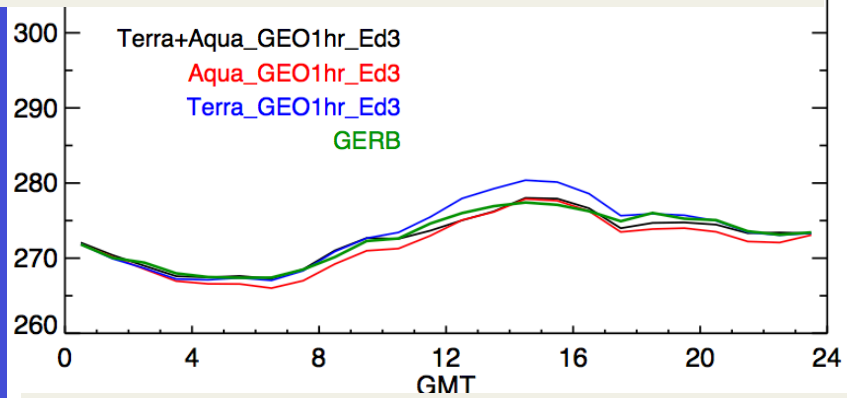
Ed4 Sahara desert, Jan 2010



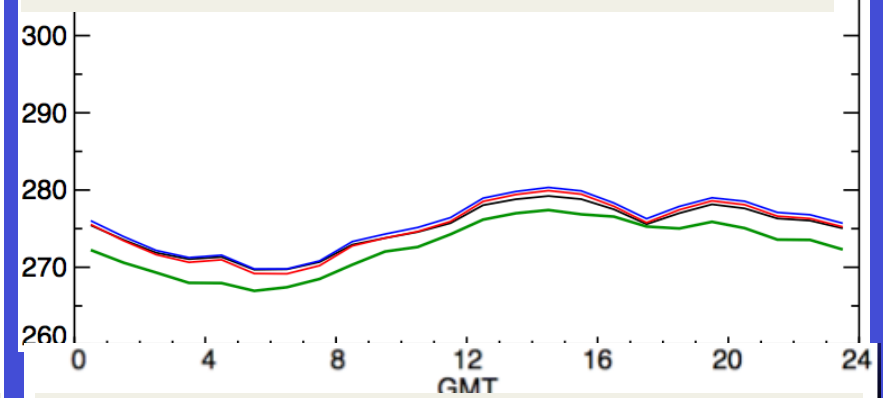
Ed3 Sahara desert, Jan 2010



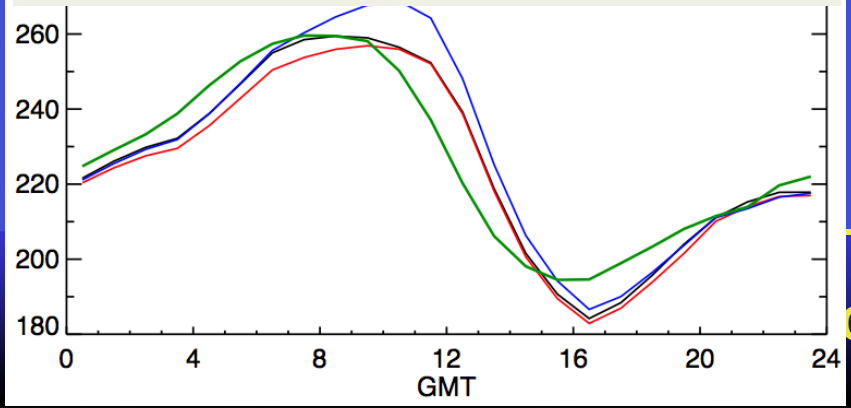
Ed3 Namibian Stratus, Jan 2010



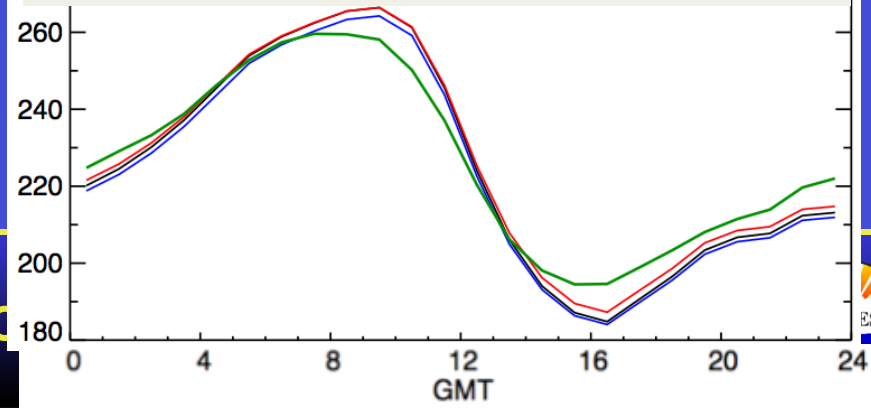
Ed4 Namibian Stratus, Jan 2010

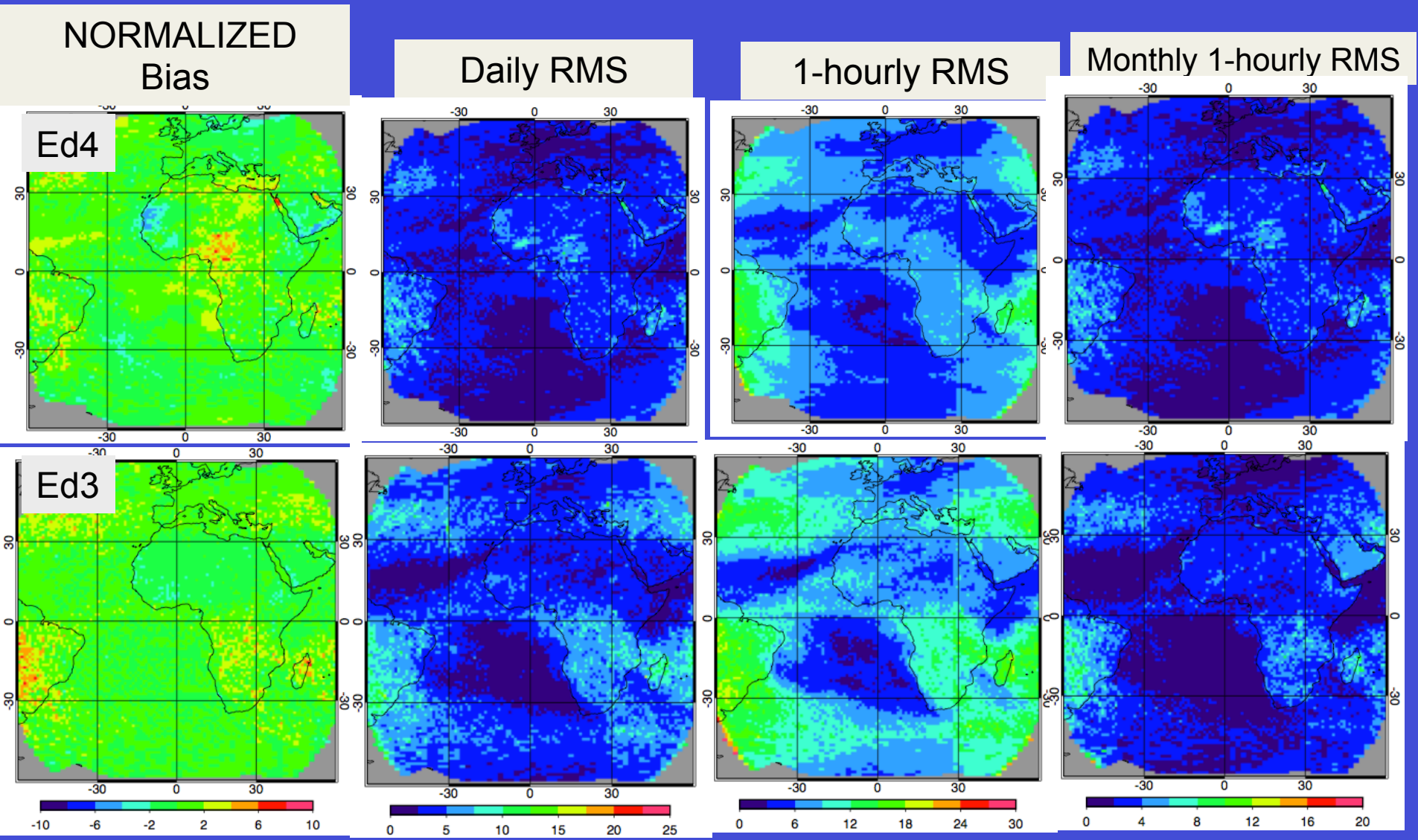


Ed3 Madagascar, Jan 2010



Ed4 Madagascar, Jan 2010





GEO LW normalized (%)	Bias	monthly	daily	3hour	1hour	M3hour	M1hour
Edition 4	0.14	0.59	1.48	2.43	2.77	0.92	1.07
Edition 3	0.19	0.53	1.76	3.19	3.55	0.93	1.10

NOT NORMALIZED

Bias

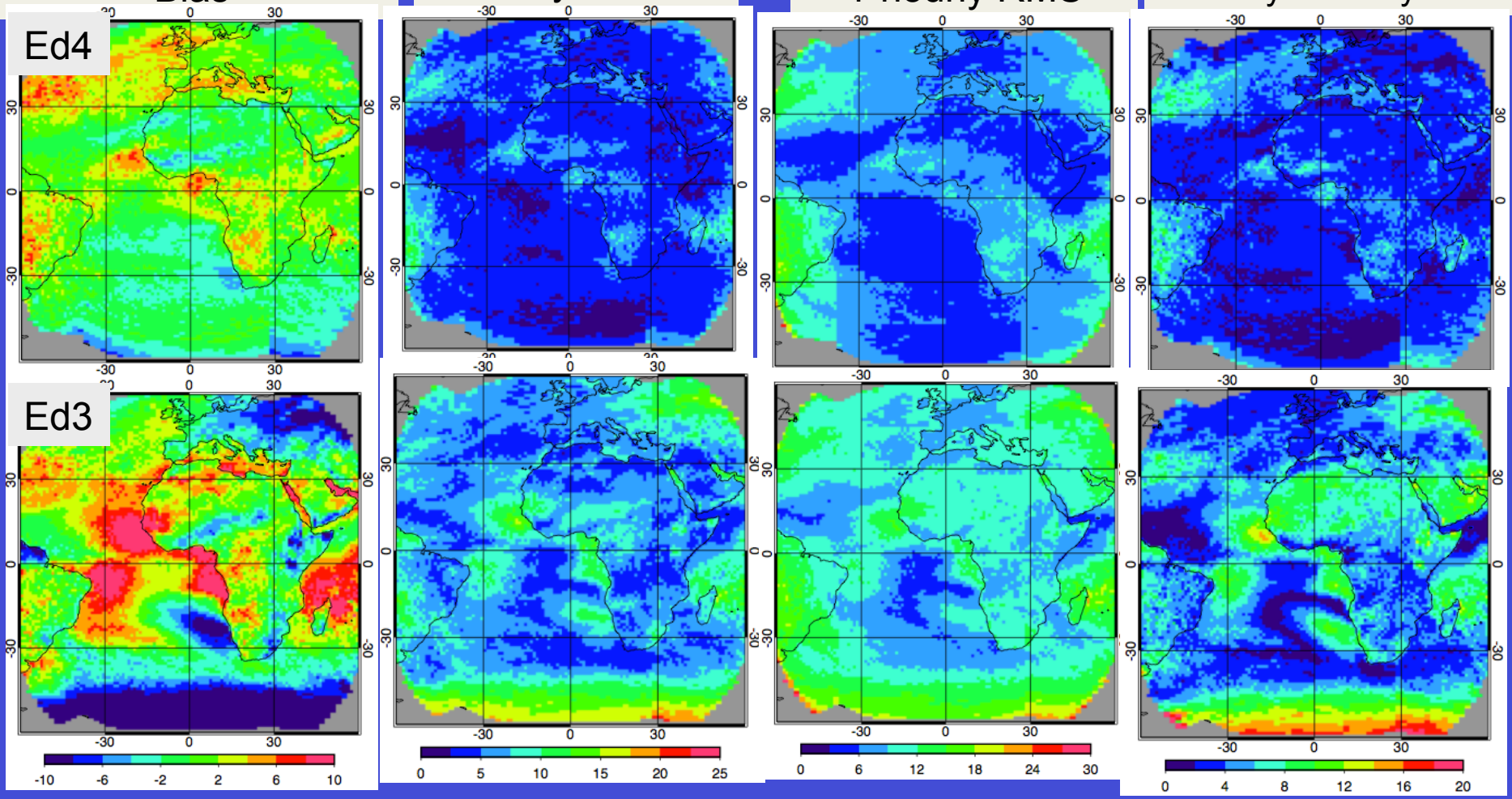
Daily RMS

1-hourly RMS

Monthly 1-hourly RMS

Ed4

Ed3



GEO LW (%) not normalized	Bias	monthly	daily	3hour	1hour	M3hour	M1hour
Ed4	0.20	0.99	1.67	2.58	2.92	1.20	1.33
Ed3	0.04	2.22	2.86	3.88	4.19	2.20	2.32

Conclusions

- The TISA group uses GERB and ScaRaB fluxes to validate the GEO derived broadband flux algorithms
  - The GERB and ScaRaB are radiometrically scaled to CERES observed fluxes, this includes both instrument calibration and overall ADM biases
- Assume the following flux uncertainty
  - CERES <= GERB/ScaRaB <<< GEO derived
  - Remove cases where there are known flux biases

Future Efforts

- TISA group will work with ScaRaB gridded product group to formulate dataset that will provide the best comparison fluxes
  - 2/3 of coincident matches occur for VZA>45°
  - Many 40-km overlapping ScaRaB footprints may sample outside of the 1° by 1 ° lat/lon region, find the most uniform scenes for fair comparison
- For GERB use HR product
  - Perform GERB Edition 2/GEO comparisons over the July 2004 and January 2010 (GERB-2), January and July 2010 (GERB-1), and January and July 2013 (GERB-3)
  - This will test GOES-12,13, Met-5,7,8,9 derived broadband fluxes
- CERES SYN1deg 1-hour Ed4 product will carry flags
  - Whether the TOA flux is from CERES, GEO, or temporally interpolated